



The Role of Trade Openness, Financial Development and Institutional Quality in the Environmental Performance of a Developing Country: Evidence from Nigeria

دور الانفتاح التجاري، والتطور المالي، وجودة المؤسسات في الأداء البيئي لدولة نامية: حالة نيجيريا

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Abstract: Nigeria's natural resources have been under increasing strain from deforestation, pollution, resource extraction, and land degradation. These challenges, compounded by climate change, highlight the urgent need to improve the quality of the environment to ensure a sustainable development. Therefore, there is a need to identify factors that influence environmental performance to forestall further strain on the resources. It is against this backdrop that this study examines the impact of economic growth, population growth, trade openness, financial development and governance on environmental performance in Nigeria. Utilizing annual time series data from 1995 to 2022 and employing the Autoregressive Distributed Lag (ARDL) approach, the findings revealed that in the short run, economic growth and trade openness had a significant positive impact on environmental performance. Similarly, financial development had a positive but insignificant effect on environmental performance. Institutional quality showed a delayed positive impact, emphasizing the importance of governance improvements in achieving consistent environmental outcomes. Conversely, population growth negatively impacted environmental performance in the short run. In the long run, financial development and institutional quality significantly enhanced environmental performance. However, economic growth exhibited a significant negative effect on environmental performance. These findings suggest that Nigeria should prioritize enhancing financial development and institutional frameworks to promote sustainable environmental outcomes while managing population growth to mitigate its adverse effects on the environment.

Keywords: Environmental performance, economic growth, governance, trade openness, Environmental Performance Indicator (EPI)

ملخص:

تتناول هذه الدراسة تأثير النمو الاقتصادي، والنمو السكاني، وانفتاح التجارة، والتطور المالي، ونوعية الحوكمة على الأداء البيئي في نيجيريا. اعتماداً على بيانات سنوية خلال الفترة من 1995 إلى 2022، وباستخدام منهجية الانحدار الذاتي للفجوات الموزعة (ARDL)، وتوصلت الدراسة إلى أن النمو الاقتصادي والانفتاح التجاري كان لهما تأثير إيجابي كبير على الأداء البيئي في الأمد القصير. كذلك، ساهم التطور المالي في تحسين الأداء البيئي، وإن كان تأثيره غير ذي دلالة إحصائية. أما جودة المؤسسات، فقد أظهرت أثراً إيجابياً مؤجلاً، مما يشير إلى الدور الحيوي الذي تلعبه الحوكمة الجيدة في تحقيق نتائج بيئية مستقرة، وفي المقابل، كان للنمو السكاني تأثير سلبي على الأداء البيئي في الأمد القصير. وعلى المدى الطويل، تبين أن كلاً من التطور المالي وجودة المؤسسات يساهمان بشكل ملحوظ في تحسين الأداء البيئي. غير أن النمو الاقتصادي، على خلاف ذلك، أظهر تأثيراً سلبياً كبيراً على البيئة في هذا الأمد.

وتشير هذه النتائج إلى أن على نيجيريا أن تركز على تعزيز القطاع المالي وتحسين البنية المؤسسية كأولوية لدعم الاستدامة البيئية، بالتوازي مع ضبط النمو السكاني للتخفيف من آثاره السلبية على البيئة.

الكلمات المفتاحية: الأداء البيئي، النمو الاقتصادي، الحوكمة، الانفتاح التجاري، مؤشر الأداء البيئي.

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1. Introduction

Environmental performance refers to a measurement of how well an organisation, country, or system is performing in terms of minimising its environmental impacts. It includes reduction of greenhouse gas emissions and mitigation of climate change, efficient use of resources (water, energy and raw materials), waste management (reducing, reusing and recycling waste), minimisation of air, water and soil pollution, and biodiversity conservation (Sachs et al., 2022). Environmental performance has emerged as a critical global issue as countries balance economic growth with the preservation of ecosystems and natural resources. According to Jahanger et al. (2024), the dual challenge of achieving economic development without sacrificing environmental quality represents a primary obstacle to environmental performance for many economies. For Nigeria, this challenge is particularly pressing due to its rapidly growing population, urbanization, and expanding industrial activities, all of which place significant pressure on the environment (Akadiri et al., 2022). These factors have contributed to a range of environmental issues, including deforestation, water pollution, and land degradation, compounded by the effects of climate change (Ogundipe, 2020).

The pursuit of sustainable development in Nigeria requires a multifaceted approach that considers not only greenhouse gas emissions but also broader indicators of environmental health. Commonly used indicators, such as carbon dioxide emissions and the ecological footprint, provide valuable insights into environmental impact but are limited in their scope. For example, while carbon emissions data have been the focus of numerous studies (Aiyetan & Olomola, 2017; Lin et al., 2015; Ogundipe et al., 2020; Onifade, 2023; Rafindadi, 2016), these indicators do not fully capture the demand on and availability of natural resources. Similarly, the ecological footprint focuses predominantly on consumption without adequately addressing the supply side of environmental resources (Dam & Sakodie, 2023). To provide a more comprehensive and robust analysis, this study utilises the Environmental Performance Index (EPI), a composite index which ranks countries based on their environmental health and ecosystem vitality, providing a comprehensive assessment of how well nations manage environmental challenges. Developed by a team of researchers and policy experts at the Yale Centre for Environmental Law and Policy and Columbia University's Centre for International Earth Science Information Network (CIESIN) in collaboration with the World Economic Forum in 2006, the EPI evaluates countries on various performance indicators, such as air quality, water and sanitation, biodiversity, climate policy, and resource management (Hsu & Zomer, 2014). It provides a standardised framework for comparing environmental progress and identifies areas needing improvement, fostering accountability in meeting global environmental goals (Esty, 2008).

This study, therefore, adopts this index (EPI) to investigate the impact of trade openness, financial development, and governance on Nigeria's environmental performance using the Autoregressive Distributed Lag (ARDL) approach. By using the EPI, a comprehensive and internationally recognised metric for environmental performance, this study differs from existing studies which often focus on narrower indicators, such as carbon emissions and ecological footprint and thus provides a broader perspective on environmental sustainability. This approach does not only highlight key policy interventions but also set the groundwork for developing strategies that holistically target environmental sustainability.

The rest of the paper is structured as follows: Section 2 provides a review of relevant literature, Section 3 details the model and methodology, Section 4 presents and discusses the findings, and Section 5 concludes with implications and recommendations.

2. Review of Literature

Research on the determinants of environmental sustainability consistently underscores the roles of trade openness, financial development, and governance in shaping environmental outcomes, with variations arising from regional economic structures and governance capacities. In Nigeria, Mesagan and Nwachukwu (2018) found that while financial development and income levels positively impacted environmental quality, they also exerted pressure through increased CO₂ emissions and energy demands, though without a reciprocal effect between financial growth and the environment. Extending this to South Asia, Bhutta et al. (2022) observed that although financial development boosted economic activities, it failed to curb emissions independently, underscoring the importance of governance frameworks that encourage green finance and sustainable investments. These findings reflect a need to balance financial expansion with policies that promote eco-friendly growth. Meanwhile, the impact of trade openness on environmental quality remains complex. Wang et al. (2021) found that trade openness significantly raised emissions in oil-dependent African nations, including Nigeria, by intensifying extraction-driven pollution, while non-oil economies experience relatively lesser environmental impacts. Ogundipe et al. (2020) corroborated this with evidence of a direct link between Nigeria's fossil fuel reliance and rising emissions, showing that without sustainable trade practices, openness can worsen environmental degradation in resource-dependent economies.

Research by Antweiler et al (2001) underscores that trade can lead to environmental improvements through a “technique effect,” where access to cleaner technologies enhances production methods. However, the “scale effect” of trade, which results in increased production, may also heighten environmental degradation, especially in resource-intensive economies (Le et al., 2016). For Nigeria, Omoke et al. (2021) concludes that good governance and quality institutions can channel the gains of trade openness into growth-enhancing activities.

Financial development, another pivotal factor, can support environmental sustainability by channeling investments into green technologies and sustainable initiatives. According to Zaidi et al. (2019), a well-developed financial sector fosters innovation and enables firms to invest in environmentally friendly technologies, contributing to improved environmental outcomes. Nonetheless, financial development may also fuel industrial expansion, which can lead to environmental degradation if sustainability considerations are overlooked (Al-Mulali et al., 2015).

Governance plays a crucial role in the environmental domain as it shapes the effectiveness of policies and regulations governing resource use. Strong institutions promote transparency, policy stability, and enforcement capabilities, which are essential for environmental protection (Baloch et al., 2018). Conversely, poor governance often results in regulatory failures, unsustainable resource exploitation, and environmental harm, as seen in countries with weak governance frameworks (Acheampong & Dzator, 2020). Institutional reforms aimed at strengthening governance and accountability are thus essential to aligning economic goals with environmental protection. Governance and institutional quality have proven pivotal in mitigating the adverse effects of trade and financial growth on environmental outcomes. For instance, Ali et al. (2019) found that robust institutions across developing countries effectively reduce emissions by strengthening environmental governance. Similarly, Acheampong and Dzator (2020) highlighted that in sub-Saharan Africa, governance factors like regulatory quality and rule of law significantly improve environmental quality, particularly in nations with British or French legal legacies. These findings indicate that the effectiveness of institutional interventions may depend on historical governance structures. Didia et al. (2022) further supported this view, noting that although some governance variables like political stability had no significant effect, others, including government effectiveness and the rule of law, were essential in enhancing environmental performance, suggesting that targeted improvements in governance can yield direct environmental benefits.

Ahmed et al. (2020) employed an ARDL approach to demonstrate how institutional quality can mitigate environmental degradation effects linked to financial development and trade. Their study supports the notion that effective governance frameworks can enhance sustainable development by managing financial growth's environmental impact, while Bhutta et al. (2022) similarly noted that green innovation and renewable initiatives succeed when actively supported by governance frameworks. Together, these insights suggest that for Nigeria, a proactive regulatory framework encouraging green finance and technological R&D could help mitigate the environmental impacts of financial and trade growth.

3. Methodology

3.1 Theoretical Framework

This study rests on the framework of the Environmental Kuznets Curve (EKC) to account for the interaction between environmental management, economic growth and institutional quality. The EKC hypothesis posits an inverted U-shaped relationship between environmental degradation and economic growth (Grossman & Krueger, 1991). According to this hypothesis, in the early stages of economic growth, environmental degradation and pollution tend to increase, but after reaching a certain level of income per capita, the trend reverses, leading to environmental improvement as economies continue to grow.

3.2 Model Specification

Following Didia et al. (2022), we specified the model for this study as

$$EPI_t = \alpha_0 + \beta_1 TOP_t + \beta_2 FD_t + \beta_3 POP_t + \beta_4 GDP_t + \beta_5 IQ + \varepsilon_t \quad (1)$$

This model, which differs from Didia's by inclusion of financial development variable and exclusion of debt variable, has Environmental Performance Index (EPI) as the dependent variable, measuring environmental sustainability. In this model, economic growth is represented by per capita GDP, globalization reflects efforts by countries to maintain or enhance international competitiveness in trade, social factors capture environmental pressures arising from population dynamics or population density (POP), and institutional quality (IQ) encompasses indicators such as government stability, law and order, political stability, democratic accountability, and control of corruption, collectively representing institutional effectiveness.

Narayan and Narayan (2010) argued that to solve the problem of multicollinearity, varying variance and to calculate elasticities, short-run and long-run income elasticities should be compared by adopting a linear model. Hence, the natural logarithm of all variables was taken to avoid multicollinearity, heteroscedasticity and to obtain the elasticities of the variables using a double logarithmic model.

$$\ln EPI_t = \alpha_0 + \beta_1 \ln TOP_t + \beta_2 \ln FD_t + \beta_3 \ln POP_t + \beta_4 \ln GDP_t + \beta_5 IQ + \varepsilon_t \quad (2)$$

where EPI, the dependent variable, is a measure of environmental sustainability; trade openness is represented by TOP; FD represents financial development; social factors capture pressures on the environment resulting from the population (POP); IQ represent institutional quality measured by government stability, law and order, democratic accountability, and control of corruption. Economic growth is captured by growth rate of per capita GDP. α_0 is the intercept/slope, β_1 to β_6 are the parameters, "t" denotes the study period in years involved, and the term, ε_t is the error/disturbance term.

3.3 Estimation Technique

The estimation technique adopted for this study is the autoregressive distributed lag. Autoregressive distributed lag (ARDL) is a least squares regression consisting of the lags of the dependent variables and of the explanatory variables. This technique allows for the investigation of both short-term and long-term effects and is particularly suitable for exploring the interplay between the variables, considering the time series nature of the data. The ARDL linear specification for Equation 2 is thus:

$$\begin{aligned} \Delta \ln EPI_t = & a_0 + \sum_{k=1}^n \gamma_k \Delta \ln EPI_{t-k} + \sum_{k=0}^p \eta_k \Delta \ln TOP_{t-k} + \sum_{k=0}^p \theta_k \Delta \ln FD_{t-k} + \sum_{k=0}^p \lambda_k \Delta \ln POP_{t-k} \\ & + \sum_{k=0}^p \partial_k \Delta \ln IQ_{t-k} + \sum_{k=0}^p \delta_k \Delta \ln GDP_{t-k} + a_1 \ln EPI_{t-1} + a_2 \ln TOP_{t-1} \\ & + a_3 \ln FD_{t-1} + a_4 \ln POP_{t-1} + a_5 \ln IQ_{t-1} + a_6 \ln GDP_{t-1} + \epsilon_t \end{aligned} \quad (3)$$

3.4 Data

This study employed a quantitative research approach to assess the impact of trade openness, financial development, and institutional quality on environmental performance in Nigeria, utilizing secondary data spanning from 1995 to 2022. Based on a time series data analysis, the dataset includes the Environmental Performance Index (EPI) as the dependent variable and several independent variables: economic growth measured by Gross Domestic Product (GDP), financial development measured by a broad-based financial development index, trade openness represented by trade as a percentage of GDP, population size measured by total individuals, and institutional quality measured by the index of the four institutional variables. The EPI is derived from 40 environmental indicators and encompasses subcategories such as Climate Change (PCC), Environmental Health (HLT), and Ecosystem Vitality (ECO) (Wolf *et al.*, 2022). Data for institution were sourced from the International Country Risk Guide by The PRS Group and computed using Principal component analysis (Eigen values), while all other variables were obtained from the World Bank's World Development Indicators Database.

4. Results

The descriptive statistics in Table 4.1 show that environmental sustainability (LNEPI) had a mean value of 3.59, with relatively low variation, indicating stability over the observed period. Per capita GDP (LNGDP) had a mean of 7.62, with moderate variability, while population (LNPOP) was relatively stable around its mean of 18.85. Trade openness (LNTO) varied more widely, suggesting fluctuations in trade policies. Institution (IQ) had a mean of 1.142 and a standard deviation of 0.959, showing moderate variability, with values ranging from a minimum of 0.02 to a maximum of 4.21. Financial development (LNFD) had negative mean value of -1.60 on average, likely suggesting a lower level of financial services accessibility or integration.

Table 4.1 Descriptive Statistics and Correlation Analysis Result

		LNEPI	LNGDP	LNPOP	LNTO	IQ	LNFD
Mean		3.591801	7.623538	18.85422	3.575373	1.141974	-1.597144
Median		3.558684	7.707524	18.85554	3.671422	1.016064	-1.576104
Maximum		3.792744	7.893406	19.20249	3.975523	4.209850	-1.299291
Minimum		3.483514	7.264739	18.49938	2.794362	0.020111	-1.932236
Std. Dev.		0.080807	0.232316	0.217497	0.297658	0.958881	0.137390

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Observations		28	28	28	28	28	28
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Source: Authors' Computation

The correlation analysis in Table 4.2 shows that LNEPI (Environmental Performance Index) has a weak positive correlation with LNGDP (0.37) and LNFD (0.41), indicating a mild association between environmental performance, economic growth, and financial development. IQ (Institutional Quality) has a positive correlation with LNEPI (0.62), LNGDP (0.58), and LNPOP (0.43), suggesting that higher institutional quality is associated with higher economic and population metrics. LNT0 (Trade Openness) has mixed relationships, being positively correlated with IQ (0.09) but negatively with LNPOP (-0.66).

Table 4.2	Correlation Matrix						
		LNEPI	LNGDP	LNPOP	LNT0	IQ	LNFD
LNEPI		1.00					
LNGDP		0.37	1.00				
LNPOP		0.13	0.92	1.00			
LNT0		0.21	-0.50	-0.66	1.00		
IQ		0.62	0.58	0.43	0.09	1.00	
LNFD		0.41	0.78	0.76	-0.39	-0.38	1.00

Source: Authors' Computation

Table 4.3 presents the results of the unit root tests carried out to determine the stationarity of the time series and their levels of integration. Employing Augmented Dickey-Fuller and Philips-perron test, the result shows that except for log of financial development that is stationary at level form, all other variables obtained stationarity after first difference. The implications of the mixed order integration are that certain estimation techniques cannot be applied to estimate the specified model. In this case, the most appropriate linear regression estimation is the autoregressive distributed lags (ARDL) test. But first the ARDL bond test for cointegration will be conducted to ascertain if there exist a long run relationship between the variables.

Table 4.3 Unit root test

Variables	ADF		PP		Conclusion
	Statistics	Prob.	Statistics	Prob.	Integration
LnEPI	-3.452022	0.0181	-3.438566	0.0186	I (1)
lnGDP	-4.541420	0.0008	-4.621057	0.0006	I (1)
lnIQ	-3.258745	0.0277	-5.244246	0.0001	I (1)
lnPOP	-3.627532	0.0431	-3.252211	0.0281	I (1)
LnFD	-3.762603	0.0356	-2.651610	0.0955	I (0)
IQ	-3.818965	0.0078	-3.734717	0.0095	I (1)

Source: Authors' Computation

Table 4.4 provides evidence that the variables are linked in the long term. Looking at the table, the F-statistics for the linear ARDL approaches higher than the upper limits for both 5% and 10% significance levels. This suggests a long-run relationship.

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Table 4.4 ARDL Bounds Test

ARDL Bounds Test				
Sample: 1998 2022				
Included observations: 25				
Null Hypothesis: No long-run relationships exist				
Test Statistic	Value	K		
F-statistic	17.67398	5		
Critical Value Bounds				
Significance	I0 Bound	I1 Bound		
10%	2.26	3.35		
5%	2.62	3.79		

Source: Authors' Computation

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The ARDL results in Table 4.5 offer critical insights into the determinants of environmental performance in Nigeria, aligning with key empirical findings. The short-run analysis highlights that economic growth had mixed effects on environmental performance. Specifically, a 1% increase in the previous year's economic growth significantly reduced current environmental performance by 0.70%, while a 1% increase in economic growth from two years ago enhanced it by 0.53%. The former finding resonates with Mesagan and Nwachukwu (2018) who observed that economic growth could negatively impact environmental quality in resource-dependent economies but may improve it when aligned with sustainability efforts.

Trade openness had a significant positive short-run effect, with a one-period lag increasing environmental performance by 0.057%. This finding contrasts with Ogundipe et al. (2020) who reported that trade liberalization in oil-exporting African nations often exacerbates emissions. However, the positive impact in this study suggests that Nigeria may benefit from trade openness through the adoption of environmentally friendly technologies or compliance with international environmental standards.

Table 4.5 Regression Results

ARDL Cointegrating And Long Run Form				
Dependent Variable: LNEPI				
Selected Model: ARDL(1, 3, 2, 2, 1, 3)				
Sample: 1995 2022				
Included observations: 25				
Cointegrating Form (Short-Run Coefficients)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.

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D(LNGDP)	-0.074814	0.211224	-0.354194	0.7336
D(LNGDP(-1))	-0.698788	0.174747	-3.998851	0.0052
D(LNGDP(-2))	0.529651	0.208235	2.543520	0.0385
D(LNPOP)	-35.563537	16.863055	-2.108962	0.0729
D(LNPOP(-1))	30.879656	23.576457	1.309767	0.2316
D(LNTO)	0.013907	0.018620	0.746874	0.4795
D(LNTO(-1))	0.056666	0.018159	3.120611	0.0168
D(LNFD)	-0.088477	0.047849	-1.849089	0.1069
D(IQ)	-0.020660	0.013148	-1.571394	0.1601
D(IQ(-1))	-0.001875	0.008349	-0.224517	0.8288
D(IQ(-2))	0.043830	0.011291	3.881743	0.0060
CointEq(-1)	-0.345667	0.067423	-5.126882	0.0014
Long-Run Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	-1.537673	0.452984	-3.394544	0.0115
LNPOP	0.525591	0.521667	1.007523	0.3472
LNTO	-0.169381	0.127633	-1.327103	0.2261
LNFD	0.631310	0.176585	3.575105	0.0090
IQ	0.238603	0.088303	2.702082	0.0305
C	7.644701	8.828946	0.865868	0.4153

Source: Authors' Computation

Conversely, population growth exerted a negative short-term impact on environmental performance, as a 1% increase in population growth resulted in 35.5% decline in environmental performance. This aligns with findings from Wang et al. (2021) who found that population pressures contributed to increased emissions, particularly in resource-dependent economies. The challenge of managing population growth to balance environmental objectives is underscored in our results, suggesting that environmental policies should consider population dynamics to effectively mitigate ecological pressures.

Institutional quality (IQ) was found to have a delayed but significant positive impact, as an increase in institution quality in the last two years led to a 0.044% increase in environmental performance. This corroborates findings by Didia et al. (2022) and Jilanguo et al. (2022) that governance and institutional frameworks played a significant role in reducing emissions and promoting green investments.

In the long run, financial development was found to be a significant driver of environmental performance, with a 1% increase contributing to a 0.63% rise in environmental performance. This

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finding aligns with Bhutta et al. (2022) that financial sector growth fostered green investments, provided it is backed by strong institutional frameworks. Institutional quality also positively influences long-term outcomes, with a 1% increase improving environmental performance by 23%. This supports Acheampong and Dzator (2020) who discovered the stabilizing effects of governance on environmental sustainability.

Conversely, economic growth exerted a negative long-term effect, with a 1% increase leading to a 1.54% reduction in environmental performance. This finding is consistent with Wang et al. (2021), who noted that industrial-driven growth in developing economies often intensifies environmental degradation, underscoring the need for sustainable growth strategies.

The error correction term (-0.3457) indicates that 34.57% of any disequilibrium is corrected within one period, confirming a stable long-term relationship. This supports Ali et al. (2019), who emphasized the dynamic interplay between institutional structures and environmental sustainability. These results provide actionable insights into how economic policies and governance can shape Nigeria's environmental outcomes, emphasizing the importance of balancing growth with sustainability goals.

Diagnostic Tests

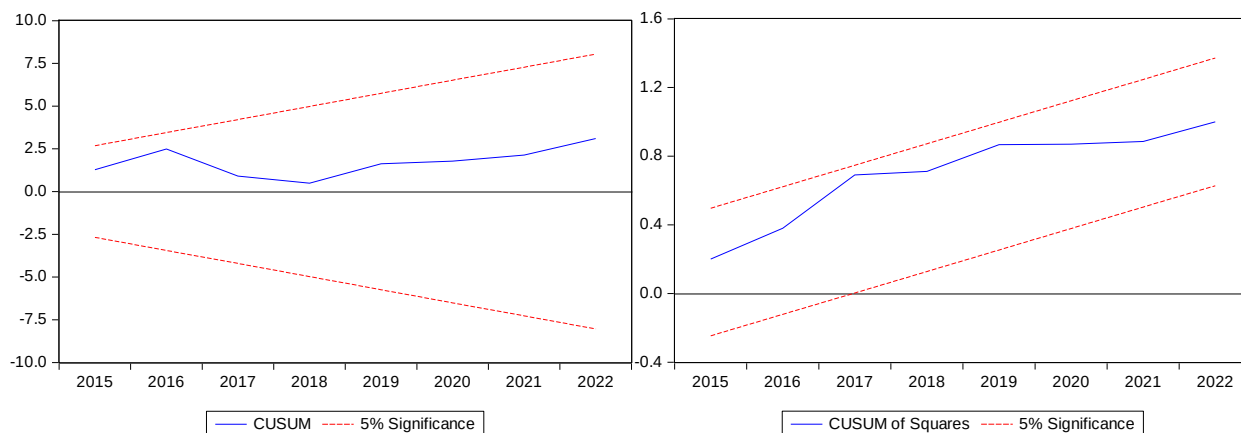
According to Table 4.6, the values of R-squared and adjusted R-squared in the model indicate that the explanatory variables respectively accounted for about 99% and 98% of the variations in environmental performance. The significant values of F-statistics (73.37928) obtained show that the independent variables are jointly significant. The Durbin-Watson statistic points to the absence of autocorrelation, meaning that the residuals were uncorrelated in the respective models. The insignificant values of the Jarque-Bera test reveal that the variables were normally distributed. Furthermore, the Breusch-Pagan-Godfrey test with insignificant F-statistic of 1.298036 from the ARDL model shows that the residuals were homoscedastic, that is, the residuals did not differ across all values of the exogenous variables. The CUSUM and CUSUMSQ plots in Figures 1 and 2 reveal that the long-run coefficients are stable since both of their plots stay inside the critical bounds.

Table 4.6 Diagnostic Test

Test	ARDL
R-squared	0.997282
Adjusted R-squared	0.983691
F-statistic (p-value)	73.37928 (0.000400)
Durbin-Watson	3.657183
Jarque-Bera (p-value)	0.467768 (0.79145)
Breusch-Pagan-Godfrey	1.298036 (0.3664)

Source: Authors' Computation

Figure 1. CUSUM AND CUSUM SQUARED TEST



5. Conclusion

This study assesses the impact of trade openness, financial development, and institutional quality on environmental performance in Nigeria using ARDL approach, providing insights into both short- and long-term dynamics. The findings reveal that in the short run, economic growth and trade openness positively influence environmental sustainability, indicating that Nigeria's integration into the global economy may encourage environmentally friendly practices, such as enhanced technology adoption and adherence to international environmental standards. Population growth exerts a negative short-term effect on sustainability, underscoring the ecological pressures associated with Nigeria's demographic expansion. Institutional quality shows a delayed positive impact, emphasizing the importance of governance improvements in achieving consistent environmental outcomes. However, short-term fluctuations in institutional quality underscore the need for stable governance frameworks to support environmental sustainability. Long-term analysis highlights institutional quality and financial development as critical drivers of environmental performance, with institutional quality fostering green investments and stabilizing environmental outcomes. This indicates that financial development alone may not achieve maximum environmental benefits without governance mechanisms to guide investment decisions. While the direct impacts of financial development and institutional quality on environmental performance are evident, their potential combined effect warrants further exploration. This perspective aligns with the growing consensus that financial growth must be underpinned by institutional quality to achieve sustainable development. Policymakers should prioritize strengthening governance frameworks to maximize the environmental benefits of financial development in Nigeria. For instance, governance ensures transparency, accountability, and policy coherence, which are vital for promoting green finance and mitigating ecological risks. Thus, the synergy between financial development and governance represents a pivotal area for future research and policy intervention in aligning financial growth with environmental sustainability goals in Nigeria. Conversely, economic growth negatively impacts environmental performance in the long run, reflecting the challenges of balancing industrial-driven growth with sustainability goals. Trade openness continues to show positive long-term effects, suggesting that environmentally sound trade practices and regulatory measures can enhance sustainability. However, these benefits depend on policies that align trade liberalization with ecological protection. These findings highlight the need for Nigeria to prioritize governance reforms and financial sector development aimed at supporting sustainable growth. Integrated trade policies and strategies to manage population dynamics are essential to balance economic growth with environmental preservation.

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